SB761
U7U6
#83-2

United States
Department of
Agriculture

Forest
Service

**Northern
Region**

Forest Insect and Disease Conditions 1982

in Montana

Montana
Department of
State Lands

Division of
Forestry

REPORT 83-2
MARCH 1983

LIBRARY
JUL 83
ROCKY MOUNTAIN STATION

Cover Story

Douglas-fir tussock moth periodically causes damage throughout western Montana. Severe defoliation may result in top kill or tree mortality in Douglas-fir and true firs. Tussock moth populations fluctuate widely, and during periods of low density the insects are difficult to detect using conventional sampling methods. Pheromone-baited traps provide an aid in monitoring critical population changes. The sticky-coated traps are baited with synthetic female sex pheromone. Male moths attracted to the traps provide an index to potential larval populations the following year. This early warning system for Douglas-fir tussock moth enables managers to implement control measures before serious damage occurs.

FOREST INSECT AND DISEASE CONDITIONS IN MONTANA

1982

Compiled by

Steve Kohler

Chris Niwa

Suzanne H. Dubreuil

Report No. 83-2

March 1983

U.S. Department of Agriculture
Forest Service, Northern Region
Cooperative Forestry and Pest
Management
P. O. Box 7669
Missoula, Montana 59807

Montana Department of State Lands
Division of Forestry
Forest Insect & Disease Section
2705 Spurgin Road
Missoula, Montana 59801

TABLE OF CONTENTS

	Page
INTRODUCTION	1
SUMMARY OF CONDITIONS	1
INSECTS	
Bark Beetles	2
Mountain Pine Beetle	2
Spruce Beetle	13
Douglas-fir Beetle	15
Western Balsam Bark Beetle	16
Other Bark Beetles	17
Defoliators	17
Western Spruce Budworm	17
Larch Casebearer	21
Pine Butterfly	22
Douglas-fir Tussock Moth	22
Pine Needle Sheath Miner	22
Ponderosa Pine Needle Miner	22
Other Insects	22
Western Pine Shoot Borer	22
Lodgepole Pine Terminal Weevil	23
Leafminers of Hardwoods	23
A Root-collar Weevil	23
Pine Bark Aphid	23
Ten-lined June Beetle	24
DISEASES	
Root Diseases	24
Kootenai National Forest	24
Lolo National Forest	28
Helena National Forest	28
Flathead National Forest	31
Bitterroot National Forest	31
Beaverhead National Forest	31
Foliage Diseases	31
Cankers	34
Dwarf Mistletoes	35
Nursery Diseases	36
COMMON AND SCIENTIFIC NAMES	37
RECENT REPORTS AND PUBLICATIONS	39

INTRODUCTION

This report is the third since the adoption of a new format covering forest insect and disease conditions on all ownerships (federal, state, and private) on a state-by-state basis. It has been prepared jointly by the USDA Forest Service, Cooperative Forestry and Pest Management; and the Montana Department of State Lands, Forestry Division. A similar report covering Idaho has been prepared by the USDA Forest Service and the Idaho Department of Lands.

This report will provide a historical record of insect and disease outbreaks in Montana's forests. It will also provide forest land managers with estimates of resource losses and knowledge of the severity and magnitude of current insect and disease infestations. This information will aid land managers and the public in making sound decisions on where to direct efforts to reduce losses from forest pests.

SUMMARY OF CONDITIONS

Mountain pine beetle continued to be the most destructive forest insect on lands of all ownerships in Montana. All pine species were affected, and infestations covered nearly 2,143,000 acres statewide. Spruce beetle infestations, centered in the Flathead and Kootenai National Forest areas and the Stillwater, Coal Creek and Swan River State Forests, increased to more than 41,000 acres. Douglas-fir beetle infestations increased to 3,550 acres. Western balsam bark beetle infested more than 9,000 acres of subalpine fir. Populations of fir engraver, pine engraver, and western pine beetle were relatively static. Collectively they infested only about 600 acres throughout the State. Western spruce budworm populations increased significantly in 1982. More than 2,250,000 acres of host type on all ownerships in Montana and Yellowstone National Park showed aerially visible defoliation. Defoliation from larch casebearer reached its lowest level in several years. Populations of pine butterfly increased noticeably in portions of western Montana during 1982, though no visible defoliation was detected. Douglas-fir tussock moth defoliated ornamental blue spruce in Polson, Somers and Missoula. Pheromone-baited sticky trap catches of male moths made in 1982 indicated a continued upward population trend. Pine needle sheath miner infested thousands of acres of ponderosa pine south of Helena. Surveys of the impact of western pine shoot borer in western Montana ponderosa pine plantations showed reductions in height growth of as much as 16 percent. Widespread damage in lodgepole pine plantations from lodgepole pine terminal weevil continued in 1982. Birches and aspens throughout western Montana were heavily defoliated by three species of leafmining insects. A root-collar weevil killed many small lodgepole pines near West Yellowstone. Pine bark aphids and June beetles continued to damage Scotch pine Christmas tree plantations in the Bigfork and Kalispell areas.

Root diseases were the most damaging tree diseases in Montana. New detections of root-diseased stands were numerous. Armillaria root rot, brown cubical root and butt rot, and laminated root rot were most frequently encountered. Black stain root disease is now known from ten locations in Montana. Annosus root rot caused two percent mortality in a sapling

ponderoa pine plantation on the Lolo National Forest. Damage from Hypodermella blight and Meria needlecast to western larch was visibly reduced from the previous year. Lodgepole pine needlecast was again very evident. Several reports of Douglas-fir needlecast were received. The frequency of fir-fireweed rust disease on the Kootenai and Flathead National Forest areas was unusually high. Swiss needlecast was detected on Douglas-fir throughout the Fortine District, Kootenai National Forest. Delphinella tip blight was damaging on subalpine fir in a few locations. Peridermium rust disease of lodgepole pine infected with dwarf mistletoe was found for the first time in Montana. Cytospora tip canker of subalpine fir infected 40 acres on the Beaverhead National Forest. A lodgepole pine stand on the Helena National Forest and another on the Flathead Indian Reservation were severely damaged by Atropellis canker. Several lodgepole stands on the Beaverhead National Forest had severe comandra blister rust infections. White pine blister rust continued to be a major limiting factor to white pine production. Impact from dwarf mistletoes continued to decrease with continued implementation of forest management through stand treatment, and with special suppression projects on the Bitterroot and Kootenai National Forests and the Garnet Resource Area, BLM. Ponderosa pine seedlings grown at the Coeur d'Alene Nursery for Montana national forests had western gall rust disease. Damping off continued to cause problems in nonfumigated seedbeds at the Champion Timberlands Nursery. A serious canker disease of Russian-olive was found at the Montana Department of State Lands Nursery in Missoula.

INSECTS

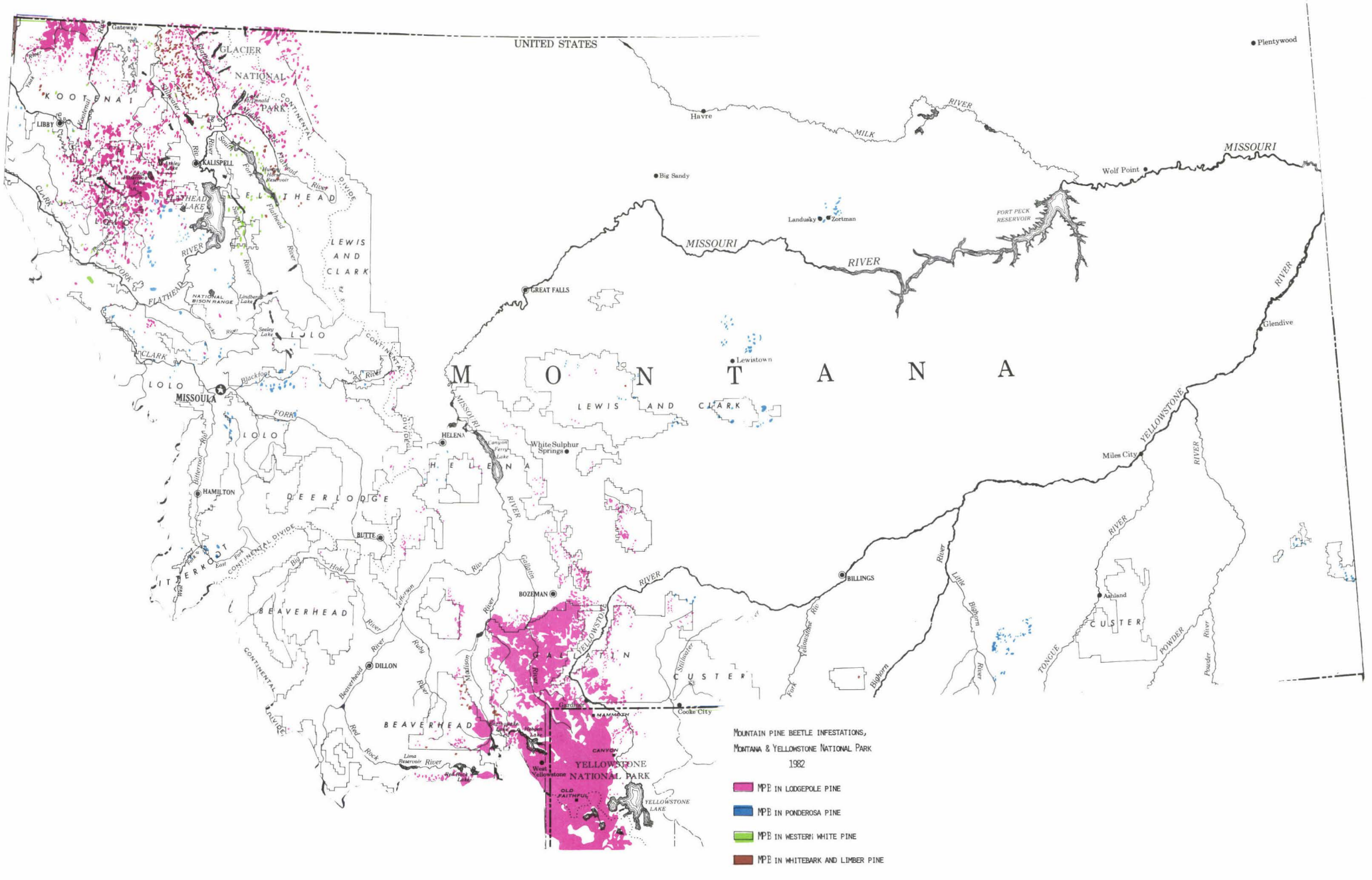
Bark Beetles

Mountain Pine Beetle

Mountain pine beetle continued to be the most destructive forest insect on lands of all ownerships in Montana. Though beetle populations declined in several areas during 1982, infestations persisted in the Beaverhead, Flathead, Gallatin, Kootenai, Lewis & Clark and Lolo National Forest areas; in Glacier and Yellowstone National Parks, the Blackfeet, Crow, and Flathead Indian Reservations; and on BLM and private lands in the Centennial Mountains. In most areas where infestations declined, it was the result of depletion of suitable large diameter host trees in stands that have been infested for several years. Less extensive infestations occurred elsewhere, most notably in the Custer, Deerlodge and Helena National Forest areas, and on Fort Belknap and Northern Cheyenne Indian Reservations (Figure 1).

Most mountain pine beetle mortality occurred in lodgepole pine. Throughout Montana (including Yellowstone National Park), over 1,700,000 acres of lodgepole on federal lands were infested during 1982 (Table 1). More than 25,000 acres of whitebark pine type and over 30,000 acres of ponderosa pine were affected by mountain pine beetle on federally administered lands. Less extensive mortality to western white pine type continued within the State.

Figure 1. Mountain pine beetle infestations, Montana and Yellowstone National Park, 1982.


UNITED STATES
MONTANA
Gateway
GLACIER NATIONAL PARK
KOOTENAI
LIBBY
KALISPELL
FLATHEAD LAKE
FLATHEAD
LEWIS AND CLARK
LOLO
MISSOULA
HAMILTON
DEERLODGE
BUTTE
BEAVERHEAD
DILLON
HELENA
GREAT FALLS
Havre
Big Sandy
Landusky
Zortman
Wolf Point
Plentywood
Lewistown
White Sulphur Springs
Miles City
Glendive
BOZEMAN
BILLINGS
Aahland
CUSTER
GALLATIN
MADISON
Gardiner
Cooke City
YELLOWSTONE NATIONAL PARK
CANYON
OLD FAITHFUL
YELLOWSTONE LAKE
West Yellowstone
Hebgen Lake
Lima Reservoir
Red Rock River
Ruby River
Beaverhead River
Jefferson River
Big Hole River
Gallatin River
Madison River
Yellowstone River
Little Bighorn River
Tongue River
Powder River
Missouri River
Milk River
Fort Peck Reservoir
Clark Fork
Flathead River
Kootenai River
Blackfoot River
Bitterroot River
Clearwater River
Swan River
Stillwater River
Lake Koocanusa
Hungry Horse Reservoir
Seeley Lake
Lindbergh Lake
National Bison Range
Canyon Ferry Lake
CONTINENTAL DIVIDE
MOUNTAIN PINE BEETLE INFESTATIONS,
MONTANA & YELLOWSTONE NATIONAL PARK
1982
MPB IN LODGEPOLE PINE
MPB IN PONDEROSA PINE
MPB IN WESTERN WHITE PINE
MPB IN WHITEBARK AND LIMBER PINE

On State and private lands in Montana in 1982, mountain pine beetle infested over 290,000 acres of lodgepole pine, almost 2,000 acres of whitebark pine, over 85,000 acres of ponderosa pine and over 2,000 acres of western white pine (Table 2).

Significant efforts for silvicultural manipulation in high hazard lodgepole pine stands were made statewide in 1982 despite the substantial number of these stands already brought under management in previous years, the reduced demand for timber, and declining beetle populations in some areas. In 1982 more than 403 million board feet were removed from just over 51,000 acres (Table 3). For the period 1973-1981, over 780 million board feet were removed from almost 100,000 acres.

Beaverhead National Forest Area--A decrease in infested lodgepole pine type from 120,000 acres in 1981 to 90,000 acres in 1982 occurred on federal lands (Table 1). Mortality in whitebark pine increased dramatically, from just over 500 trees in 1981 to over 5,000 trees in 1982. The majority of the infestation is still concentrated within the Madison District. Lodgepole pine and whitebark pine faders were seen on the west side of the Madison Range from Earthquake Lake north to Ennis Lake, and on the east side of the Gravelly Range. The southeast portion of the Tobacco Root Mountains also contained lodgepole pine mortality. All but two of the 14 lodgepole pine stands ground surveyed showed a decrease in the 1982 attack rate. In 1981, an average of 18.5 trees per acre were killed, while the 1982 average was only 5.1 attacks per acre.

Acres of infested lodgepole pine on private lands in the Beaverhead National Forest area decreased from 62,840 in 1981 to 44,397 in 1982 (Table 2). Infestation in whitebark pine increased from 30 acres in 1981 to 894 acres in 1982. Most of the damage on private lands occurred on the north side of the Tobacco Root Mountains, in the Centennial Mountains, and on the west side of the Madison Range from Earthquake Lake north to Ennis Lake.

Though localized, heavy mortality is expected to continue in the Beaverhead National Forest area. The beetle infestation is believed to be decreasing east of the Madison River, but an increase in mortality is predicted for many stands west of the Madison River.

Bitterroot National Forest Area--Groups of from five to 30 ponderosa pine faders occurred along the East Fork of the Bitterroot River on the West Fork District. The amount of national forest land infested was down from 830 acres last year to just scattered mortality in 1982. Infestation on state and private lands continued in ponderosa pine in the Eightmile Creek drainage east of Florence and in areas near Trapper Creek Job Corps Center and Sula Peak. Infested acreage increased sharply in 1982 to 2,286 acres.

Centennial Mountains--The Centennial Mountains south of Red Rock Lakes continued to support the largest infestation on BLM administered lands. Over 17,500 acres of lodgepole pine mortality were mapped in 1982; about 1,000 acres less than in 1981.

Table 1.--Acres of mountain pine beetle infestation on federal lands in Montana and Yellowstone National Park, 1981 and 1982.

Ownership	1981				1982			
	LPP 1/	WBP	PP	WWP	LPP	WBP	PP	WWP
Beaverhead NF	119,565	530	-	-	89,834	5,642	-	-
Bitterroot NF	1,180	-	830	-	-	-	-	-
Custer NF	400	1,576	7,940	-	60	350	-	-
Deerlodge NF	880	40	-	-	520	-	-	-
Flathead NF	108,622	7,100	-	6,276	41,723	18,634	-	1,060
Gallatin NF	455,985	-	-	-	432,492	-	200	-
Helena NF	340	30	-	-	411	15	-	-
Kootenai NF	108,755	120	300	-	119,468	640	110	140
Lewis & Clark NF	250	120	10,262	-	20	-	17,660	-
Lolo NF	10,030	-	250	-	18,089	-	80	580
Glacier NP	189,350	740	500	1,300	31,619	150	5	40
Yellowstone NP	964,878	-	-	-	957,728	-	-	-
Blackfoot IR	5,168	-	-	-	7,606	-	-	-
Crow IR	-	-	4,090	-	-	-	1,180	-
Flathead IR	-	-	200	-	1,990	-	1,815	-
Fort Belknap IR	-	-	1,620	-	-	-	633	-
N. Cheyenne IR	-	-	10	-	-	-	200	-
Rocky Boy's IR	-	-	5	-	-	-	-	-
BLM	18,414	-	4,425	-	-	-	8,464	-
TOTALS								
National Forests	806,007	9,516	19,582	6,276	702,617	25,281	18,050	1,780
National Parks	1,154,228	740	500	1,300	989,347	150	5	40
Indian Reserv.	5,168	-	5,925	-	9,596	-	3,828	-
BLM	18,414	-	4,425	-	-	-	8,464	-
All Federal	1,983,817	10,256	30,432	7,576	1,701,560	25,431	30,347	1,820

1/ LPP = lodgepole pine; WBP = whitebark pine; PP = ponderosa pine; WWP = western white pine

Table 2.--Acres of mountain pine beetle infestation on State and private lands in in Montana, 1981 and 1982

Reporting Area	1981				1982			
	LPP	WBP	PP	WWP	LPP	WBP	PP	WWP
Beaverhead	62,840	30	-	-	44,397	894	-	-
Bitterroot	-	-	350	-	-	-	2,286	-
Custer	90	-	400	-	-	-	-	-
Deerlodge	-	-	-	-	-	-	-	-
Flathead 1/	65,637	-	300	600	28,989	200	-	623
Gallatin	180,537	-	140	-	140,000	25	60	-
Garnets	-	-	3,733	-	-	-	4,704	-
Helena	-	-	-	-	20	-	90	-
Kootenai	33,080	-	660	-	50,075	-	650	30
Lewis & Clark 2/	-	-	44,086	-	-	-	78,069	-
Lolo 3/	14,930	-	730	80	14,549	-	-	-
Stillwater	1,000	100	-	1,270	15,138	700	-	1,500
TOTALS	358,114	130	50,399	1,950	293,168	1,819	85,859	2,153

1/ Includes Swan River
2/ Includes Judith River
3/ Includes Thompson River

Table 3.--Lodgepole pine volume removed in response to mountain pine beetle (includes sanitation, salvage and removal of high risk green) 1982.

Ownership	Acres treated	Volume removed (MMBF)
Federal		
Beaverhead NF	2,500	26.3
Flathead NF	9,200	56.2
Gallatin NF	1,700	26.3
Kootenai NF	27,000	220.0
Lolo NF	1,789	6.9
BLM	200	2.0
Private		
Burlington Northern	2,700	20.0
Champion International	2,300	13.6
State Dept. of Lands	4,000	32.0
TOTAL	51,389	403.3

Custer National Forest Area--Infestations of all host species were down on both national forest and state and private lands this year. Though nearly 8,000 acres of ponderosa pine mortality were reported on the Sioux District in 1981, only scattered groups of from one to 20 dead trees were observed in 1982. Mortality declined in the Long Pine area northwest of Camp Crook, south of Ekalaka near Ekalaka Park, and ceased in the Short Pine region by Moreau Peak.

White bark pine mortality on the Beartooth District decreased from 1,500 acres in 1981 to 350 acres in 1982. Most of the infestation was located near Line Creek Guard Station south of Red Lodge. Approximately 60 acres of infested lodgepole pines were observed in the northwest corner of the Beartooth District from Meyer Mountain to Mendenhall Creek.

Deerlodge National Forest Area--Lodgepole pine mortality declined on Forest Service lands from almost 900 acres in 1981 to just over 500 acres in 1982. Faders were found on the Jefferson District principally in the area between Delmoe Lake and Homestake Pass. Scattered groups of three to 30 dead trees were also located south of Boulder near Elder Creek Campground and in the northeast portion of the Bull Mountains. Again, no beetle activity was observed on state and private lands in the Deerlodge National Forest area.

Flathead National Forest Area--Infested lodgepole pine stands within the Forest decreased from 109,000 acres in 1981 to 42,000 acres in 1982. Beetle infestations declined on all ranger districts except Swan Lake, which increased slightly. National forest acreage of western white pine attacked also dropped from over 6,000 acres last year to 1,000 in 1982. Over 18,500 acres of white-bark pine were mapped this year, an increase of about 11,500 acres over the 1981 total. This increase may not be significant, because in 1981 white-bark pine was often not distinguished from other host species during aerial survey mapping. Infestations in lodgepole pine on state and private lands in the Flathead National Forest area continued to decline. Just under 29,000 acres were recorded for 1982, compared with more than 65,000 acres for 1981. Infested acreages of white-bark and western white pine remained about the same. A total of 200 acres of white-bark pine were infested in 1982, and 623 acres of western white pine. Most of the mortality in white pine was observed in the Swan River drainage and consisted of small scattered groups of trees, though some larger group kills occurred.

A majority of the lodgepole pines infested on national forest lands were located on the Glacier View District, where 32,000 acres of beetle mortality were recorded. However, at the one location where ground evaluations were conducted on the District, no attacks were observed for either of the past two years, while 52 trees per acre were killed in previous years. This indicates the beetle population has declined due to depletion of susceptible host material in the infestation area. The apparent discrepancy in the number of acres of mortality recorded during aerial surveys and the attack rate may be due to the difficulty in distinguishing between recent and old faders from the air. Most of the mortality in white-bark pine on federal lands also occurred in the North Fork of the Flathead River, where groups of ten to 100 dead trees were observed.

Increases in population trend were recorded in two of the three lodgepole pine stands ground checked on the Hungry Horse District. The average attack rate for 1982 was 40.7 trees per acre killed, compared to 16.0 for 1981. Most mortality was located in the northern part of the District along the Theodore Roosevelt Memorial Highway and in the area north Hungry Horse Reservoir. Western white pines on both sides of Hungry Horse Reservoir continued to be killed; however, in 1982 only 150 acres were affected, compared to over 5,000 the previous year.

Though surveys show a continued increase in the number of trees killed per acre on the Tally Lake District, the amount of acres involved has decreased steadily; from 13,000 in 1980 to 10,000 in 1981 and now down to 6,000 in 1982. The Tally Lake District delineated 360 million BF of high risk lodgepole pine for management in 1978, half of which had been sold or cut by the end of 1982. This may account for the decreasing trend in lodgepole pine mortality on the District in recent years. The infestation persisted on national forest and state and private lands in the southern portion of the District near McGregor Lake. For the 13 areas where ground data was taken, an average of 63.6 trees killed per acre were recorded in 1982, compared to 31.8 in 1981.

Both the intensity and scope of lodgepole pine mortality increased on the Swan Lake District. Four of six areas ground checked showed increases in the number of attacks per acre. The averages for the six stands were 44.9 trees killed per acre in 1982 and 21.7 in 1981. There was also a substantial increase in western white pine mortality during 1982, with over 200 faders observed. Mortality was located in the northeast part of the District from South Woodward Creek north to Echo Lake. Infestations on the Spotted Bear District remained static at low levels in 1982.

Gallatin National Forest Area--Infestation in lodgepole pine decreased slightly on federal lands with 456,000 acres attacked in 1981 and 432,000 this year. Only Gardiner District showed an increase in the number of acres infested during the past year. An infestation in ponderosa pine on the Big Timber District increased in size, but ground checks showed that the attack rate had declined from 4.6 trees killed per acre in 1981 to 0.6 in 1982.

Beetles continued to infest close to 200,000 acres of lodgepole pine type on the Gallatin District. Though high mortality persisted, ground checks showed substantially lower attack rates in 1982. Only one of eight stands surveyed contained trees with current year beetle attacks. An average of 1.0 trees per acre were killed in 1982, compared to 27.9 in 1981. However, the epidemic probably increased on many higher ridges in residual stands of whitebark and lodgepole pine. Lack of access to these areas prevented surveys from being made to determine trend.

Mortality on the Bozeman District decreased from 63,000 acres to 55,000 acres in 1982. Attack rates also declined in eight of the 10 areas ground checked. The infestation in the Bridger Mountains northeast of Bozeman decreased in 1982.

Over 105,000 acres of beetle mortality were reported this year on the Hebgen Lake District, a decrease of almost 20,000 acres from last year. Attack densities in 1981 and 1982 were comparable. The amount of beetle-infested lodgepole pine dropped from 49,000 acres in 1981 to almost 40,000 acres in 1982 on the Livingston District. Attack rates decreased on five of nine areas on the District that were evaluated. Average attacks per acre were 16.3 in 1981 and 9.5 in 1982. Infestation is predicted to increase in lodgepole and whitebark pine stands in the Yellowstone River drainage, and in lodgepole pine stands in the Crazy Mountains northeast of Livingston.

Infestations in lodgepole pine on state and private lands declined once again, down to 140,000 acres from the 180,537 recorded for 1981. High tree mortality persisted in the Hyalite and Bear Canyon areas near Bozeman, Gallatin Canyon, the Bridger Mountains, and in the Gallatin Range southwest of Livingston.

Garnets Area--Infested acres of BLM, state or privately owned ponderosa pine in the Garnet Mountains increased in 1982. Over 4,700 acres were infested in 1982, compared to 3,733 acres recorded in 1981. Most of the beetle activity was confined to the Blackfoot River drainage, with centers near Potomac and Lubrecht Experimental Forest near Greenough. Infestations were mainly in over-stocked second-growth stands, where losses are expected to continue until these stands are brought under management. Sixty-three scattered lodgepole pine faders were observed in the Garnets in 1982, though none were recorded in 1981.

Helena National Forest Area--Infestations remained at low levels this year with just over 400 acres of lodgepole pine and 15 acres of white-bark pine type containing mortality. Tree killing on the Townsend District was still confined to the Deep Creek drainage east of Townsend. Nearly 300 acres of fading lodgepole pine were observed, a slight increase from 1981. Scattered groups of lodgepole pine faders were also recorded on the Canyon Ferry, Lincoln, and Helena Districts. State and private lands in the Helena National Forest area incurred little damage, with only 90 acres of ponderosa pine and 20 acres of lodgepole pine infested.

Kootenai National Forest Area--Lodgepole pine mortality on federal lands increased slightly forestwide, from 109,000 acres in 1981 to 119,000 in 1982. Infested areas increased on most districts with the greatest rise occurring on the Fisher River District where 26,000 acres of mortality were reported in 1981 and 33,000 in 1982. The infestation on the Yaak District remained static with 74,000 acres of lodgepole pine faders.

Thirteen of 17 stands surveyed on the Fisher River District showed increases in attack density from 1981 to 1982. These stands averaged 78.0 trees attacked per acre in 1982 and 47.8 in 1981. The infestation around McGregor Lake appears to be progressing northward toward the Pleasant Valley area where suitable hosts are available.

Ground checks of 17 lodgepole pine stands on the Yaak District showed relatively static beetle populations. Averages for these areas were 24.8 trees killed per acre in 1981 and 30.1 in 1982. Only one stand, located in the East Fork of the Yaak River showed a dramatic increase in attack rate, with 110.0 attacks per acre in 1982 compared to 6.4 for 1981.

All other districts continued to receive scattered mortality with static to increasing numbers of new faders. Infestations in the Sunday Creek drainage on the Fortine District and Gold Creek on the Rexford District continued to spread. Mortality occurred in all host species, but only lodgepole pine is supporting a major infestation. Substantial increases in the number of infested acres of lodgepole pine on state or private ownership were observed. Beetle infestations were up from 33,080 acres in 1981 to 50,075 acres in 1982. The largest portion of the damage was again in areas west of Little Bitterroot Lake, north of McGregor and Thompson Lakes, and along the Fisher River. Increases in activity were also noted in the Pleasant Valley area.

Lewis and Clark National Forest Area--Acreage of ponderosa pine mortality increased from 10,000 in 1981 to over 17,500 in 1982 within national forest boundaries. However, the number of dead trees reported decreased significantly from over 20,000 last year to less than 2,000 in 1982.

All of the federal acreage affected was located on the Musselshell District. Ponderosa pine mortality occurred in the Big Sandy Mountains northeast of Harlowton and in the east end of the Belt Mountains north of Harlowton. Small groups of lodgepole pine faders occurred in the Castle Mountains southeast of White Sulphur Springs. In one lodgepole pine stand, ground checks showed 4.8 trees killed per acre in 1982 and 0.9 in 1981.

Ponderosa pine mortality on the Judith District decreased substantially in 1982. Only scattered mortality was reported, and in the three areas ground surveyed, an average of 19.1 trees per acre were killed in 1981 compared to 8.8 for 1982. Scattered mortality in lodgepole pine, whitebark pine, and ponderosa pine was also noted on the Belt Creek and Kings Hill Districts.

Over 8,000 acres of ponderosa pine type on BLM land within the Lewis and Clark reporting area were infested in 1982. Faders were located northeast of Lewistown in the Judith Mountains from Big Grassy Peak south to Limekiln Canyon. Mortality was also recorded northeast of Harlowton between the Big and Little Snowy Mountains.

Infestations in ponderosa pine on private lands in the North and South Moccasin Mountains and the Judith Mountains north of Lewistown continued to subside, though overall, infested acreage of state and privately owned ponderosa pine increased. A total of 78,069 acres were recorded for 1982, compared to 41,086 acres for 1981. The increase in infested acres was mainly east and southeast of Lewistown in the Little Snowy Mountains and Flat Willow Creek drainage. Though the infested area has continued to increase in size, the intensity has remained much the same, with just scattered single or small tree group mortality. Beetle activity has increased on the south side of the Big Snowy Mountains.

Lolo National Forest Area--More than 18,000 acres of infested lodgepole pine type were recorded on national forest land in 1982, an increase of 8,000 acres over 1981. This rise in the amount of acreage affected was accompanied by an increase in the intensity of attack in the Thompson River drainage where most of the beetle activity continued to be centered.

All but one of the areas ground checked on the Plains District showed increases in the numbers of trees killed per acre from 1981. Averages of 53.8 trees killed per acre in 1982 and 30.0 in 1981 were determined in the nine areas surveyed. The scope of the infestation also expanded markedly, with almost 16,000 acres of mortality recorded in 1982, a 50 percent increase over the previous year. Beetle activity was especially severe near Fishtrap Lake and on the northeast side of the District.

Infested areas on the Thompson Falls District doubled to 1,300 acres in 1982. Mortality was concentrated in lodgepole pine stands in the Fishtrap Creek drainage. Two hundred western white pine faders were reported near the head of 12-mile Creek on the Superior District. Scattered lodgepole pine, whitebark pine and ponderosa pine mortality was also recorded on the Missoula, Ninemile, and Seeley Lake Districts.

Acres of infested lodgepole pine on state and private lands in the Lolo National Forest area remained virtually unchanged from 1981, with 14,549 acres recorded for 1982. The mortality continued to be centered in the Thompson River drainage. Elswhere, no infestations were detected in ponderoa pine, down from the 730 acres reported in 1981.

Stillwater State Forest Area--A total of 15,138 acres of infested lodgepole pine on state and private lands was recorded for 1982. Infestations were concentrated on the west side of the Whitefish Range and in the lower Swift Creek drainage south past Meadow Lake. Activity also persisted in the Fitzsimmons Creek drainage. Acres of western white pine infested increased from 1,270 in 1981 to 1,500 in 1982. Infested acres of whitebark pine also increased.

Glacier National Park--The infestation in the Park continued to decrease, dropping from 190,000 acres in 1981 to 32,000 acres of infested lodgepole pine in 1982. The infestation also declined in all other host species within the Park in 1982. Populations on the west side from McDonald Lake to the Canadian border remained at low levels due to host depletion. Ground data from nine stands in the south and east portions of the Park showed averages of 21.0 trees killed per acre in 1981 and 17.7 in 1982. Of these areas, five showed a decrease in the number of attacks in 1982. Heavily infested stands were located in the Belly River drainage, surrounding St. Mary, Waterton, and Sherburne Lakes and along the Middle Fork of the Flathead River.

Yellowstone National Park--The number of infested acres remained about the same with 965,000 recorded in 1981 and 958,000 in 1982. However, the estimated number of new faders decreased from over 2½ million last year to less than 1½ million in 1982. Though no ground surveys were conducted this year, the substantially lower number of dead trees observed in 1982 may be a sign of a general decline in the infestation. The most notable expansion of beetle activity in the Park was along the northern border east of Gardiner between Crevice Ranger Station and Coyote Creek.

Blackfeet Indian Reservation--Infested acres on the Reservation rose from 5,000 in 1981 to over 7,000 in 1982. The infestation was still concentrated in the northwest corner of the Reservation adjacent to Glacier National Park. Small groups of beetle-killed trees were mapped on reservation lands as far south as East Glacier in 1982. The infestation is predicted to increase in 1983.

Crow Indian Reservation--Ponderoa pine mortality dropped from 4,000 acres in 1981 to 1,200 acres in 1982. Most faders were again centered around the Corral Creek drainage. Ground surveys in this area showed an increase in the attack rate in five of seven stands. Attacked trees per acre averaged 17.5 in 1981 and 26.7 in 1982.

Flathead Indian Reservation--Infestations in both lodgepole pine and ponderosa pine increased in scope and intensity. Nearly 2,000 acres of each species contained fading trees in 1982. Attack rates were higher than in previous years for two areas ground surveyed. Average numbers of trees killed per acre were 2.8 and 28.5 for 1981 and 1982 respectively. Ponderosa pine type scattered through the west side of the Reservation was attacked, and single faders to groups of 150 trees were recorded. Five to 500 tree groups of lodgepole pine mortality occurred principally in the northwest corner of the Reservation from Upper Dry Fork Reservoir north to the Reservation boundary.

Fort Belknap Indian Reservation--The ponderosa pine infestation subsided within the Reservation in 1982. In 1981 more than 1,650 acres were infested, while in 1982 just over 600 acres contained mortality. Most faders were again observed within the Beaver Creek and Bear Gulch drainages. Some scattered mortality also occurred in the Emerson Creek area.

Northern Cheyenne Indian Reservation--Ponderosa pine mortality increased on the Reservation from ten acres in 1981 to 200 acres in 1982. Groups of from two to 90 dead trees were scattered along the west side of the Reservation east of Rosebud Creek from Skunk Creek north to Bushy Creek. Ground surveys in three areas also showed an average increase in the number of new attacks, from 5.7 trees per acre in 1981 to 22.7 in 1982.

Rocky Boy's Indian Reservation--No new ponderoa pine mortality was observed on the Reservation during 1982. Ground surveys conducted in areas that had contained infestations in 1981 revealed an average of 3.8 dead trees per acre for 1981 but no new faders in 1982.

Spruce Beetle

In 1981, the first major outbreak of spruce beetle since 1970 appeared. Brood initiated in 1978 and 1979 had high survival rates due to mild winters during their 2-year development period. In 1982 over 41,000 acres of spruce faders were detected in western Montana, a dramatic increase from the 3,600 acres attacked in 1981 (Tables 4 and 5). Populations increased on the Flathead and Kootenai National Forests, the Flathead Indian Reservation, and the Stillwater State Forest, all areas where the beetles had been active in 1981. An infestation in Glacier National Park covered considerable acreage. A few trees were also killed on the Plains District of the Lolo National Forest. This area had not previously reported any spruce beetle activity.

Of all federally administered lands, the Flathead National Forest suffered the most severe damage. The North Fork of the Flathead River on the Glacier View District had almost 9,000 acres affected by spruce beetle. Areas on either side of Hungry Horse Reservoir and along Theodore Roosevelt Memorial Highway on the Hungry Horse and Spotted Bear Districts contained 5,000 acres of spruce faders. Numerous small, scattered groups of faders were recorded on the Tally Lake District. The infestation in the Swan Valley on the Swan Lake District remained at about the same level as last year, with 200 acres of spruce mortality detected. Tree kill in Glacier National Park occurred in several drainages but was most extensive in those of McDonald, Nyack, and Coal Creeks.

Table 4.--Acres of bark beetle infestations (other than mountain pine beetle) on federal lands in Montana and Yellowstone National Park, 1982

Ownership	Douglas-fir beetle	Western balsam bark beetle	Pine engraver	Spruce beetle
Beaverhead NF	350	925	-	-
Custer NF	50	-	-	-
Deerlodge NF	-	-	-	-
Flathead NF	670	2,720	-	14,565
Gallatin NF	320	3,173	-	-
Helena NF	220	-	-	-
Kootenai NF	161	-	-	682
Lolo NF	780	60	-	-
Glacier NP	420	430	250	3,340
Yellowstone NP	400	280	-	-
Blackfeet IR	-	20	-	-
Flathead IR	-	710	100	450
TOTAL				
National Forests	2,551	6,878	-	15,247
National Parks	820	710	250	3,340
Indian Reservations	0	730	100	450
All Federal	3,371	8,318	350	19,037

Table 5.--Acres of bark beetle infestations (other than mountain pine beetle) on state and private lands in Montana, 1982.

Reporting Area	Douglas-fir beetle	Western balsam bark beetle	Pine engraver	Spruce beetle
Beaverhead	-	793	-	-
Flathead	-	230	-	70
Gallatin	100	-	-	-
Lewis & Clark	-	-	40	-
Lolo	20	-	25	-
Stillwater	60	-	-	22,529
TOTAL	180	1,023	65	22,599

Spruce beetle killed trees appeared to some extent on all ranger districts of the Kootenai National Forest. Beetle populations were highest on the Fortine District, where scattered faders were observed on almost 700 acres in the north and southeast portions of the District.

The northern part of the Mission Range on the Flathead Indian Reservation contained 450 acres of spruce beetle infested stands. Within this area over 700 faders were counted. A trap tree program was initiated on the Reservation in 1982 in an attempt to reduce beetle populations.

About 22,600 acres of spruce on state and private lands were infested in 1982 (Table 5). Substantial mortality continued on the Stillwater State Forest in creek bottoms and the higher basins despite considerable effort to reduce beetle populations through salvage logging of infested and high-risk spruce. Heaviest damage occurred in Stryker and Herrig Basins, and in the Swift Creek drainage and Upper Whitefish Lake area. Through aggressive salvage logging and use of trap trees, beetle populations were reduced significantly in the Antice Creek drainage, where very few faders were observed in 1982. Beetle populations were also reduced significantly on state lands in the Coal Creek State Forest through aggressive salvage and trap trees. No new faders were observed there in 1982. Infestations continued on the Swan State Forest, where about 70 acres of state and private lands were infested. Beetle activity is expected to increase in this area.

Douglas-fir Beetle

Mortality attributable to Douglas-fir beetle increased from less than 1,000 acres to 3,550 acres over the past year (Tables 4 and 5). Most of the increase occurred on federal lands, while the number of infested acres of state and private lands remained relatively unchanged. The Beaverhead, Flathead, Gallatin, and Lolo National Forests and Glacier National Park showed increased but moderate population levels. Areas containing new Douglas-fir beetle killed trees appeared this year on the Custer, Helena, and Kootenai National Forests and in Yellowstone National Park.

The infestation on the Lolo National Forest grew considerably from seven acres in 1981 to 780 acres in 1982. Though faders were reported in most districts, mortality was concentrated principally in the Thompson River drainage. The Flathead National Forest received its most severe damage southeast of Coram where one group containing 125 dead trees was recorded. Several small groups, each containing from 2 to 15 faders, were located east of Swan Lake. An increase of Douglas-fir beetle mortality on the east side of Glacier National Park appeared to be associated with the extensive winter damage suffered in this area. All of the Douglas-fir killed in Yellowstone National Park occurred in the north-central section.

About 150 Douglas-fir faders were scattered throughout 350 acres near West Fork Campground on the Beaverhead National Forest. The dead trees occurred along the river bottom in areas of heavy budworm defoliation. Ground surveys reported an increase in the attack rate in 1982, with

an average of 11.8 trees killed per acre compared to 2.8 trees per acre killed in 1981. Mortality in the Gallatin National Forest remained static, with most attacks concentrated east of Gardiner and in groups of 20-100 dead trees along the Gallatin River in Douglas-fir stands top killed by western spruce budworm. Ground checks showed that attack rates were fairly constant in 1981 and 1982, averaging 10.0 and 7.4 trees killed per acre respectively. Mortality from Douglas-fir beetle is predicted to increase in 1983. Over 200 acres in the Arrastra Creek drainage on the Lincoln District of the Helena National Forest were infested in 1982. All ranger districts on the Kootenai National Forest reported Douglas-fir beetle activity with most mortality on the Fisher River District. Populations on the Bitterroot, Deerlodge, and Lewis and Clark National Forests and the Flathead Indian Reservation were low with only a few scattered trees being attacked.

Incidences of Douglas-fir beetle mortality were usually associated with root disease or stand disturbance such as logging activities, windthrow, or spruce budworm defoliation. To deter buildup of beetle populations, prompt salvage operations should be conducted in areas with disturbed stand conditions.

Western Balsam Bark Beetle

Over 9,000 acres of subalpine fir on all ownerships were infested by western balsam bark beetle during the past year (Tables 4 and 5). This was an increase of over 7,000 acres from 1981. On the Gallatin National Forest almost 2,500 acres of attacked trees were observed in the Boulder and West Boulder River drainages on the Big Timber District. Thompson Creek on the Livingston District and Buffalo Fork on the Gardiner District also contained notable infestations of balsam bark beetle. About 3,000 acres of faders were reported on the Flathead National Forest area, mainly on the North and Middle Forks of the Flathead River and on the west side of the Swan Valley. Over 1,700 infested acres of private and federal ownerships on the Beaverhead National Forest area were noted, primarily in the Gravelly Range. On the northeast and southeast corners of the Flathead Indian Reservation, approimately 700 acres contained subalpine fir faders. About 400 acres of attacked trees were scattered within Glacier National Park. The areas south and east of Yellowstone Lake and the northeast portion of Yellowstone National Park had a total of almost 300 acres infested by balsam bark beetle.

Other areas of minor mortality occurred on the Helena, Lewis and Clark and the Lolo National Forests and on the Blackfeet Indian Reservation. Accurate predictions of western balsam bark beetle trends are difficult due to the paucity of biological and ecological information concerning this species. Incidence of root disease, overstocking, overmaturity or physiological stress in subalpine fir stands appear to contribute to population increases of the beetle.

Other Bark Beetles

Populations of fir engraver, pine engraver and western pine beetle were relatively static. Collectively, they infested only about 600 acres throughout the State. Fir engraver was reported to have killed 80 trees over a 200-acre area in the Flathead National Forest. The extent of tree mortality caused by pine engraver decreased between 1981 and 1982. Most mortality occurred in Glacier National Park where 500 lodgepole pines were killed. These trees were scattered over a few hundred acres in the northwest section of the Park where mountain pine beetle was also present. Only a few individual ponderosa pines were attacked by the western pine beetle this year. These were located on the Middle Fork of the Jocko River on the Flathead Indian Reservation and at Harry's Flat on Rock Creek and on Johnson Creek near Superior on the Lolo National Forest.

Defoliators

Western Spruce Budworm

Western spruce budworm populations increased signicantly in 1982. Over 2,250,000 acres of host type on all ownerships in Montana and Yellowstone National Park showed aerially visible defoliation (Figure 2 and Table 6). The increase in acres defoliated over the 1981 total (931,953 acres) was the largest ever recorded (Figure 3). All reporting areas showed an increase in budworm activity in 1982 (Table 6). Outbreaks on east side Forests (Beaverhead, Deerlodge, and Gallatin) persisted and increased in intensity, while in western Montana, especially on the Bitterroot National Forest, defoliation occurred in large areas that had been undamaged since 1979 (Figure 3). Statewide, the budworm appears to be on an upward trend which should continue for several years. Egg mass collections from five national forests indicate light to moderate budworm populations in 1983. We predict that budworm defoliation will exceed three million acres in 1983. Mortality to budworm larvae from a fungus disease, Entomophthora sp., was recorded for the first time in Montana in the Miller Creek drainage near Missoula.

Figure 2. Western spruce budworm defoliation visible from the air in Montana and Yellowstone National Park, 1982.

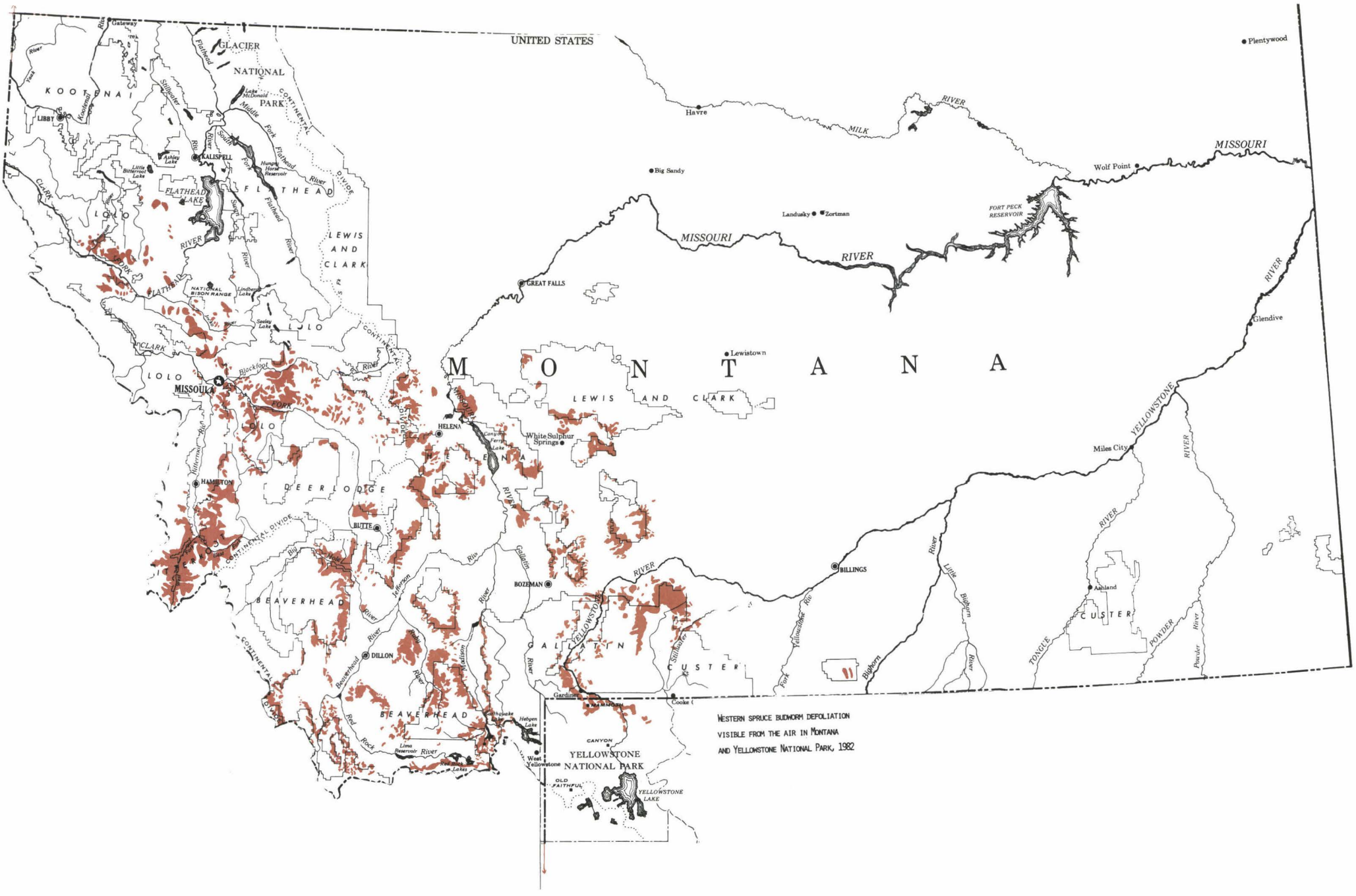

UNITED STATES
M O N T A N A
GLACIER NATIONAL PARK
CONTINENTAL DIVIDE
KOOTENAI
LOLO
FLATHEAD
LEWIS AND CLARK
DEERLODGE
BEAVERHEAD
GALLATIN
CUSTER
YELLOWSTONE NATIONAL PARK
FLATHEAD LAKE
FORT PECK RESERVOIR
MISSOURI RIVER
MILK RIVER
YELLOWSTONE RIVER
Plentywood
Havre
Big Sandy
Wolf Point
Landusky
Zortman
GREAT FALLS
Lewistown
Glendive
Miles City
Ashland
BILLINGS
BOZEMAN
BUTTE
HELENA
White Sulphur Springs
HAMILTON
DILLON
MISSOULA
LIBBY
KALISPELL
Gardiner
Cooke
WESTERN SPRUCE BUDWORM DEFOLIATION
VISIBLE FROM THE AIR IN MONTANA
AND YELLOWSTONE NATIONAL PARK, 1982

Table 6.--Acres of aerially visible western spruce budworm defoliation on all ownerships in Montana and Yellowstone National Park in 1981 and 1982.

Reporting area	1981	1982			
		Light	Moderate	Heavy	Total
Beaverhead NF	369,688	57,461	117,867	356,710	532,038
Bitterroot NF	4,330	17,093	275,743	92,565	385,401
Custer NF	14,639	3,517	5,180	23,361	32,085
Deerlodge NF	120,715	125,879	69,820	2,754	198,453
Flathead NF	7,164	7,400	0	0	7,400
Flathead IR	9,798	12,949	60,543	0	73,492
Gallatin NF	110,308	69,287	71,412	190,589	331,288
Garnet Mtns. 1/	56,353	63,174	66,022	17,210	146,406
Helena NF	56,344	164,798	43,647	24,542	232,987
Kootenai NF	0	0	0	0	0
Lewis & Clark NF	60,673	43,781	41,698	3,081	88,560
Lolo NF	84,701	45,393	111,335	25,362	182,090
Subtotal	894,713	610,732	863,267	736,174	2,210,200
Yellowstone NP	37,240	29,856	11,620	0	41,476
Grand Total	931,953	640,588	874,887	736,174	2,251,676

1/ Included in the Lolo National Forest total in reports prior to 1980.

Year	Acres of visible defoliation
1971	2,532,800
1972	2,696,769
1973	1,538,380
1974	2,020,873
1975	2,797,448
1976	2,558,623
1977	2,979,173
1978	2,465,520
1979	2,260,577
1980	974,302
1981	931,953
1982	2,251,676

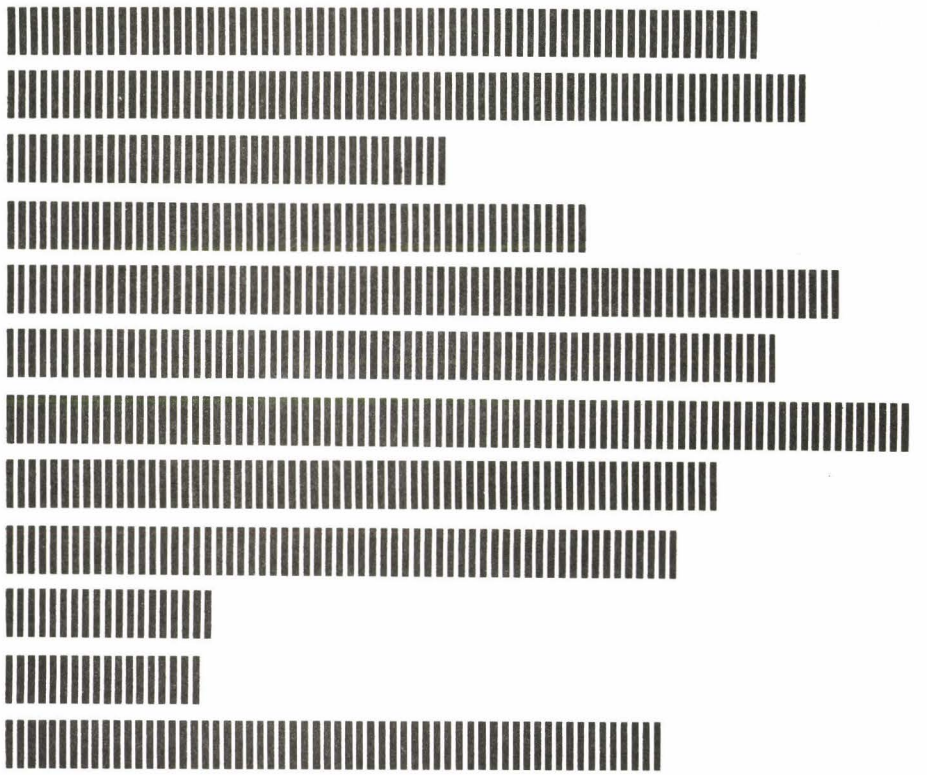


Figure 3.--Area of visible defoliation on all ownerships caused by western spruce budworm in Montana and Yellowstone National Park during the past 12 years.

A followup of the 1981 Bacillus thuringensis (Bt) pilot project was conducted in 1982. Although reared larvae showed no carryover of Bt from the previous year, the effects of the bacterial treatment were evident in tree defoliation ratings.

Western larch from Lubrecht Experimental Forest and Holloman Creek on the Lolo National Forest are being dissected and examined to determine the impact of leader and lateral severance by spruce budworm on larch growth. Monitoring of silvicultural demonstration blocks established in 1981 on the Lolo and Gallatin National Forests continued. Several regeneration cuts are being evaluated to assess the use of silvicultural strategies in reducing budworm damage. Forty-eight superior trees from the Douglas-fir tree improvement program on the Beaverhead National Forest were sprayed with Sevimol 4® to protect an abundant cone crop in 1982. Good protection of cones was accomplished on those trees that received adequate spray coverage.

Several studies related to the Canada-USA Spruce Budworms Program are presently being conducted in Montana. A simulated aerial spraying with varying concentrations and rates of Bt (ranging from 4-32 BIU/acre and from .5-3.0 gal./acre) was performed in the Fish Creek drainage on the Deerlodge National Forest. In this same area cores and discs are being examined to assess the growth impact of budworm on Douglas-fir host trees. Also on the Deerlodge, Mauget implants containing Meta-Systox-R ®, Orthene ® , or Stemix Iron and Zinc ® , and Metacaps containing Orthene ® or Dimethoate ® were applied to test their ability in protecting Douglas-fir cones (Figure 4). Spruce budworm predator population dynamics studies continued near Seeley Lake and in the Garnet Range.

Figure 4. Testing of Mauget implants to determine if systemic insecticides can protect Douglas-fir cones from spruce budworm damage.

Larch Casebearer

Both ground observations and aerial surveys showed that defoliation by larch casebearer had reached its lowest level in several years. This reduction in casebearer populations may have been due to the effects of weather, introduced parasites, and/or the widespread and heavy incidence of larch needlecast for the past few seasons.

Pine Butterfly

Populations of pine butterfly increased noticeably in portions of Montana during 1982. The number of adult butterflies observed in the Bitterroot Valley was considerably higher than in recent years. Though none was detected in 1982, visible defoliaton may possibly occur in 1983.

Douglas-fir Tussock Moth

Ornamental blue spruce were again defoliated by tussock moth larvae in Polson in 1982, and also near Somers and the Rattlesnake area of Missoula. Such defoliation of ornamentals has often preceded outbreaks of the moth in the surrounding forest areas. Though no defoliation was observed in forest stands, pheromone-baited sticky trap catches of male moths made in 1982 indicated a continued upward population trend. Of the 15 trapping locations, 10 had moth catches averaging 25 or more per trap. High catches were made at locations near Frenchtown, Albert Creek, Corral Creek, Ninemile Creek, Polson, Rollins and Somers. However, sequential lower-crown beating samples for tussock moth larvae conducted in the spring of 1982 at high trap-catch locations indicated only low population levels.

Pine Needle Sheath Miner

Pine needle sheath miner infested thousands of acres of ponderosa pine south and southeast of Helena in 1982. Defoliation was heavy in spots. This miner also heavily defoliated stands of lodgepole and limber pine throughout the Gallatin National Forest. Some of the heaviest damage occurred north and south of Bozeman.

Ponderosa Pine Needle Miner

An outbreak of ponderosa pine needle miner was detected in the Flathead Indian Reservation in 1981, causing several thousand acres of moderate defoliation near Arlee. In 1982 defoliation was not visible from the air and populations are believed to have subsided to endemic levels.

Other Insects

Western Pine Shoot Borer

The impact of western pine shoot borer (Figure 5) was assessed in selected ponderosa pine plantations of western Montana. Seventy-two plantations on the Kootenai, Flathead, Lolo, and Bitterroot National Forests were surveyed. Infestation rates ranged from 0 to 36 percent, with an average of 9 percent of the trees having infested internodes. The incidence of shoot borer was significantly lower in the west central (Lolo and Bitterroot) than in the northwest (Kootenai and Flathead) plantations. This difference was largely due to the effects of elevation, with plantations at low elevations generally having higher infestation rates than those at high elevations. The attack rates recorded represent height growth reductions for plantations as high as 16 percent and averaging 5 percent. Height growth reduction is about 30 percent for individual infested trees.

Figure 5. Growth reduction caused by western pine shoot borer. Normal terminal on left; infested terminal on right.

Lodgepole Pine Terminal Weevil

Widespread damage to the terminals of lodgepole pines in plantations continued in 1982. Plantations west of Wisdom, in the Thompson and Yaak River drainages, and near West Yellowstone displayed noticeable amounts of terminal killing by lodgepole pine terminal weevil.

Leafminers of Hardwoods

Birches and aspens throughout western Montana were heavily defoliated by three species of leafmining insects - birch leafminer, aspen blotch-miner, and aspen leafminer. Outbreaks of these pests occur sporadically in Montana.

A Root-Collar Weevil

A root-collar weevil and a bark beetle, Hylurgops porosus, killed more than 300 small lodgepole pine trees in planted stands near West Yellowstone. Lesser amounts of mortality in lodgepole pine reproduction were observed in adjacent uncut stands. Since this was not the first record of either pest killing reproduction-sized trees, we are not prepared to predict what course the outbreak will follow.

Pine Bark Aphid

High populations of pine bark aphid continued in Scotch pine Christmas tree plantations in the Bigfork and Kalispell areas. Aphid feeding damaged new growth and affected the form and appearance of trees. Some growers treated plantations early in the season with insecticides applied aerially, and were able to reduce population levels and subsequent damage.

Ten-lined June Beetle

Girdling of roots of newly planted stock in Christmas tree plantations by June beetle grubs was reported again in 1982 in the Bigfork and Kalispell areas. Some growers sustained losses as high as 25 percent of new seedlings.

DISEASES

Root Disease

Root disease infested sites are common on Montana's commercial timberlands. Root diseases post a unique management challenge because they often intensify with stand management. Once present, they are usually a permanent condition of the site. Five major pathogens are associated with most root disease problems. Diseases caused by these are Armillaria root rot, brown cubical root and butt rot, laminated root rot, annosus root rot, and black stain root disease.

Last year (1981) maps were compiled of locations on which any of the five major pathogens had been confirmed causing serious root disease problems. Nearly all of the locations were sites reported by foresters and visited by pathologists. No systematic survey was conducted, and these locations certainly represent a small proportion of the occurrences of root disease in the State. However, the maps serve to demonstrate the general distributions of root diseases. Additional locations were verified in 1982 and are described below.

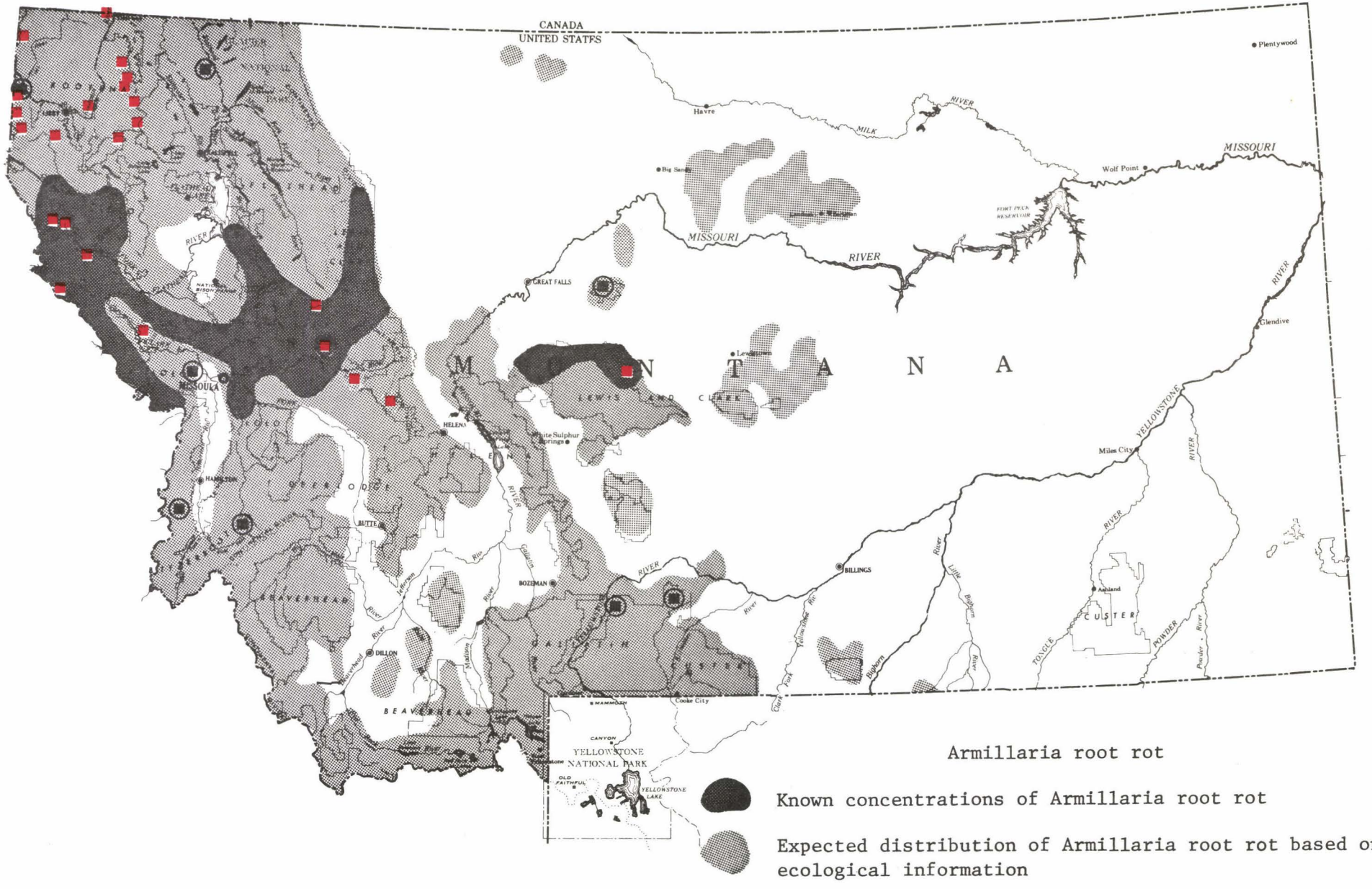
Kootenai National Forest

New detections of root-diseased stands were numerous on the Forest where a root disease impact survey was conducted. The survey was designed to derive an estimate of commercial forest area infested with root disease rather than to detect root disease forestwide. However, several new locations of root-diseased stands have been added to existing maps of known root disease as a result of the survey (Figures 6, 7, and 8). Root-diseased stands were more frequently encountered on the Cabinet District than elsewhere on the Forest. Laminated root rot was the one most frequently encountered on the Kootenai National Forest, especially on the Cabinet District. Armillaria root rot and brown cubical root and butt rot were most prevelant elsewhere on the Forest. Of 17 stands in which Armillaria root rot was found, laminated root rot was present in four and brown cubical root and butt rot in two. The latter was also found in one stand with laminated root rot and no Armillaria root rot. Further discussion of the survey results will be presented in a separate report on the Kootenai survey.

Figure 6. Distribution and expected range of Armillaria root rot in Montana.

Figure 7. Distribution and expected range of brown cubical root and butt rot in Montana.

Figure 8. Distribution and expected range of laminated root rot in Montana.



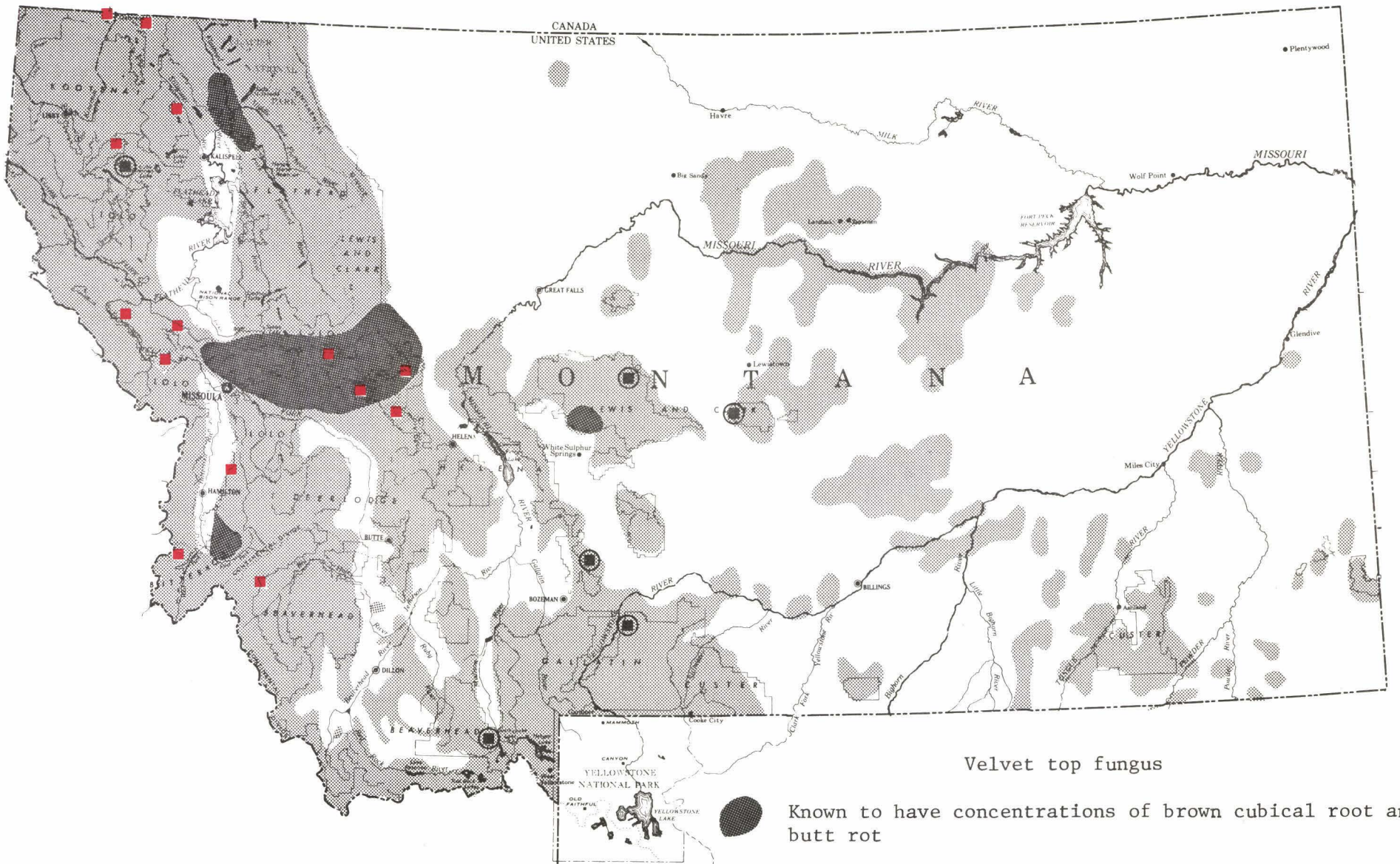
Armillaria root rot

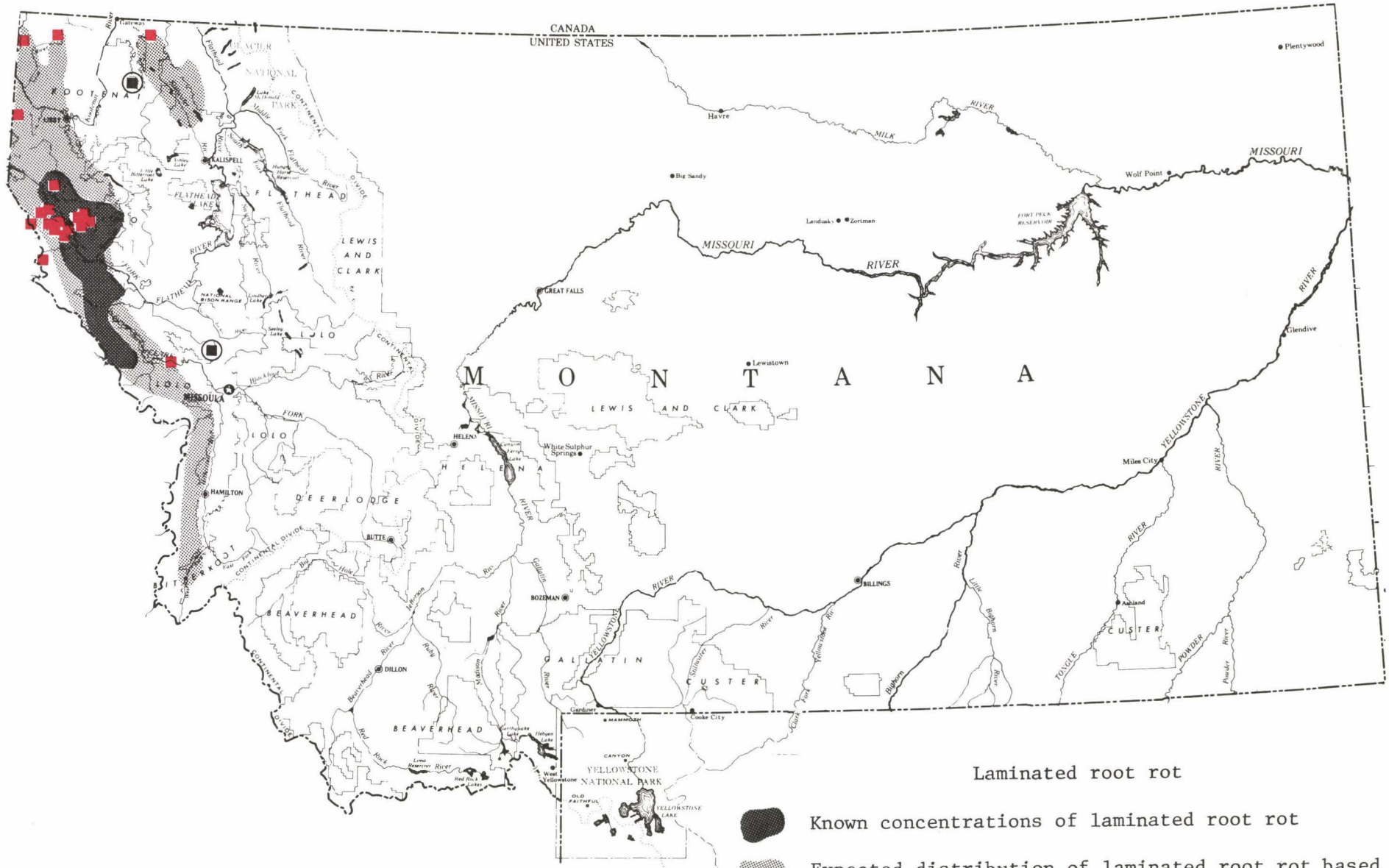
Known concentrations of Armillaria root rot

Expected distribution of Armillaria root rot based on ecological information

■ 1982 verifications of Armillaria root rot

◉ Isolated verifications of Armillaria root rot


CANADA
UNITED STATES
M O N T A N A
Velvet top fungus
Known to have concentrations of brown cubical root and butt rot
Expected distribution of brown cubical root and butt rot based on ecological information
Isolated verifications of brown cubical root and butt rot
1982 verifications of brown cubical root and butt rot.



Laminated root rot

Known concentrations of laminated root rot

Expected distribution of laminated root rot based on ecological information

Isolated verifications of laminated root rot

■ 1982 verifications of laminated root rot.

Lolo National Forest

One mature Douglas-fir on the Ninemile District was found to have black stain root disease. Ten locations in Montana are now known to have this disease (Figure 9). The tree died from black stain root disease alone; no other pathogen or primary insect was found.

Annosus root rot was found in one stand on the Superior District (Figure 10). The sapling ponderosa pine plantation had about 2 percent mortality caused by annosus root rot. Another sapling ponderosa pine plantation on the Superior District had scattered mortality caused by Armillaria root rot.

One stand with laminated root rot was found on the Ninemile District near a ridgetop in the Sawmill Gulch area. A small root disease center of about one-half acre had mature Douglas-fir and sapling subalpine fir dying with lodgepole pine surviving.

Also on the Ninemile District, three Douglas-fir stands had brown cubical root and butt rot. One of these, in Sawmill Gulch, was about 60-80 years old and had been severely defoliated by western spruce budworm about 10 years earlier. The defoliation may have contributed to the extreme amounts of root and butt decay and resulting death of many trees.

Helena National Forest

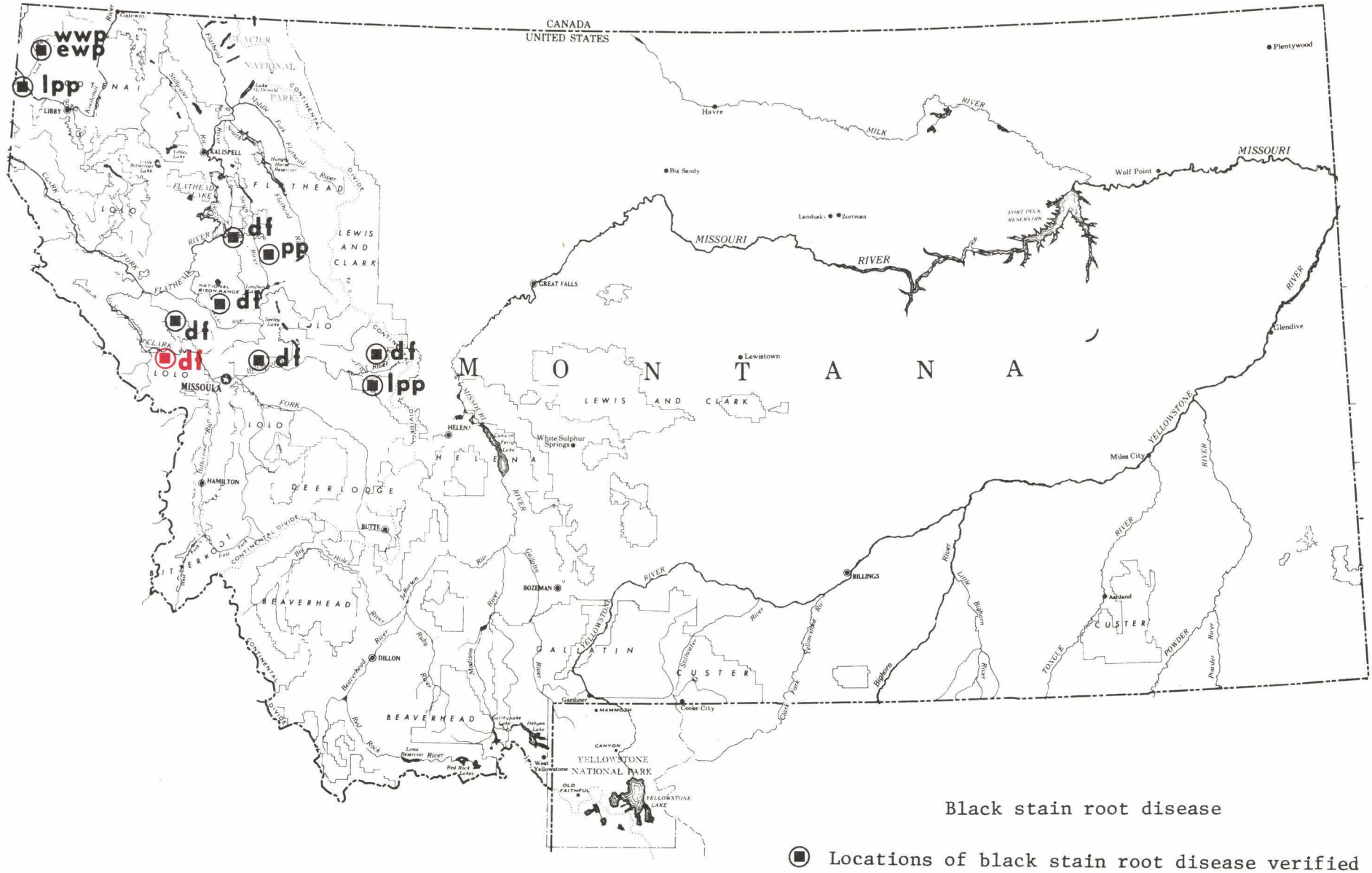
In the Dry Creek area of the Lincoln District, small groups of mature subalpine fir were dying of annosus root rot and brown cubical root rot combined with western balsam bark beetles. These stands had been identified as having Douglas-fir mortality in aerial surveys over the past few years.

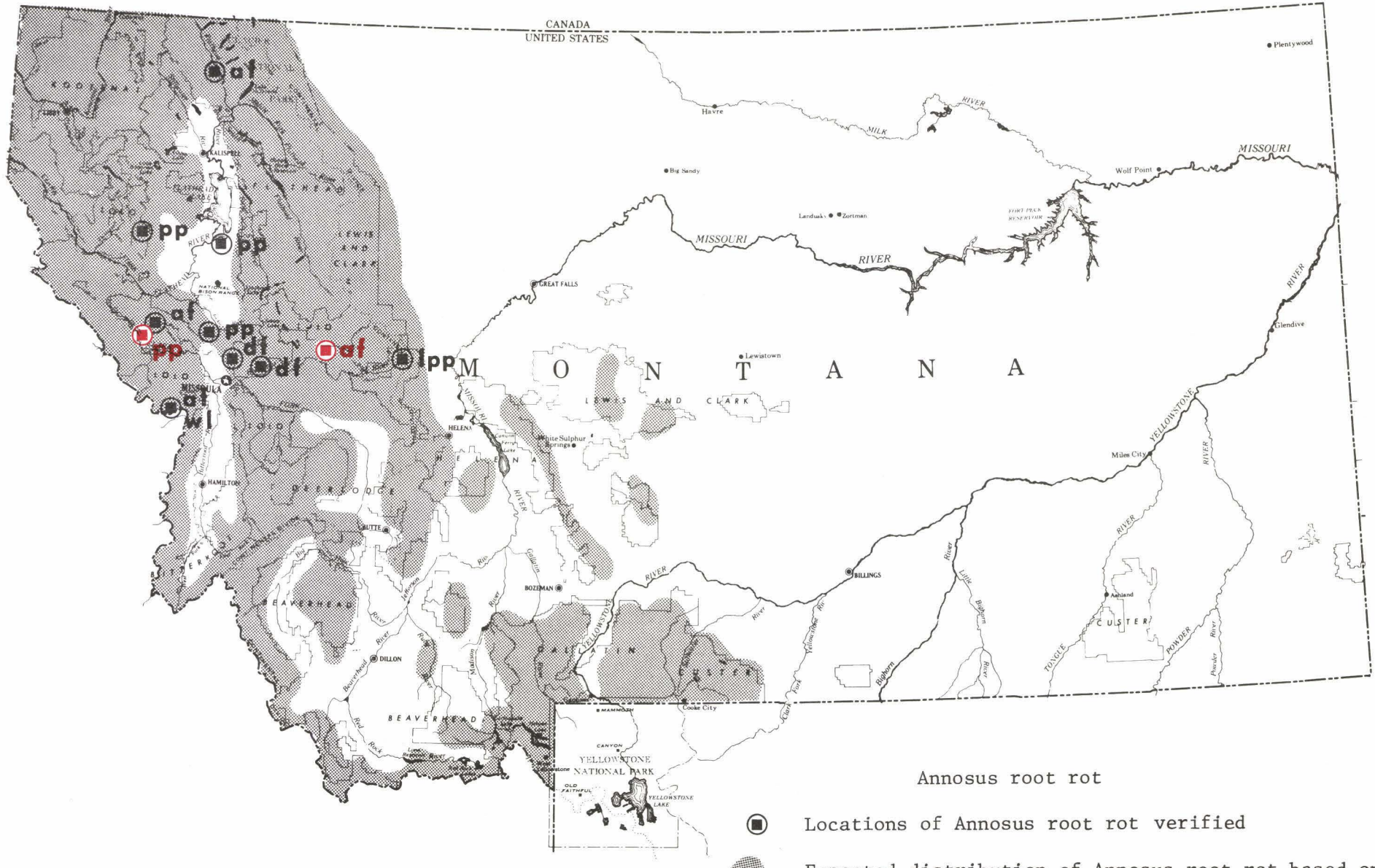
Several root-diseased stands between Dry Creek and Reservoir Lake and another in the Rossin Gulch area were detected from aerial survey maps. These areas had chronic bark beetle-associated mortality combined with with severe brown cubical root and butt rot and Armillaria root rot. The Rossin Gulch stand had been partially harvested several years earlier. This may have resulted in the current high level of mortality from Armillaria root rot.

An old-growth Douglas-fir stand in Rossin Gulch had an estimated 90 percent of the trees infected with brown cubical root and butt rot with some Douglas-fir beetle activity. This stand was implicated as having root disease from aerial detection maps. It had recurring bark beetle infestations over a 15-year period.

Figure 9. Known locations of black stain root disease in Montana.

Figure 10. Known locations and expected range of annosus root rot in Montana.


wwp
ewp
lpp
df
pp
df
df
df
df
df
lpp
CANADA
UNITED STATES
MONTANA
LIBBY
KALISPELL
MISSOULA
HELENA
GREAT FALLS
Havre
Big Sandy
Landusky
Zortman
Wolf Point
Plentywood
Lewistown
Glendive
White Sulphur Springs
Miles City
BILLINGS
BOZEMAN
BUTTE
HAMILTON
DILLON
Gardiner
Cooke City
Aahland
MISSOURI RIVER
YELLOWSTONE RIVER
MILK RIVER
LEWIS AND CLARK
DEERLODGE
BEAVERHEAD
GALLATIN
CUSTER
YELLOWSTONE NATIONAL PARK
FLATHEAD
LOLO
HELENA
BITTERROOT
CONTINENTAL DIVIDE
TONGUE
POWDER
Black stain root disease
Locations of black stain root disease verified
1982 verification of black stain root disease.


CANADA
UNITED STATES
MONTANA
Annosus root rot
Locations of Annosus root rot verified
Expected distribution of Annosus root rot based on ecological information
1982 verification of Annosus root rot.

An 80-acre root disease center on the Lincoln District near Shingle Mill Creek was examined. Douglas-fir within the center and in the surrounding stand had severe brown cubical root rot. Armillaria root disease was found only within a portion of the root disease center where Douglas-fir of all ages were dying. Windthrow was common throughout the stand surrounding the mortality center. Growth in the surrounding stand was slow, which probably contributed to the severity of brown cubical root rot. Scattered lodgepole pine appeared to be unaffected by the root diseases.

Flathead National Forest

At the north end of Tally Lake, Tally Lake District, a small mortality center with brown cubical root and butt rot was found in old-growth Douglas-fir. It had a minor, active Douglas-fir beetle population and evidence of periodic mortality over many years. Most of the dead trees had been removed by firewood cutters.

Bitterroot National Forest

Two stands on the Forest had brown cubical root and butt rot. An overmature Douglas-fir stand on the West Fork District was heavily infested with dwarf mistletoe and more than 90 percent of the trees had brown cubical root and butt rot. Some windthrown Douglas-firs were infested with Douglas-fir beetle.

Beaverhead National Forest

Wisdom District reported 10-15 trees per acre windthrown on 800-1,000 acres of sapling to overmature Douglas-fir. The trees had severe brown cubical root and butt rot. We believe that most of the residual Douglas-fir in these stands are infected.

Foliage Diseases

Incidences of Hypodermella blight and Meria needlecast of western larch were visibly reduced from 1981 on all land ownerships. However, infection levels of both pathogens were still above endemic levels and severe in a few locations, notably Swan Lake District, Flathead National Forest and Superior District, Lolo National Forest. Frequent seedling mortality and seedling top kill was evident as a result of high infection levels the previous 2 or 3 years.

Lophodermella needlecast was again very evident over much of the range of lodgepole pine, with needles infected in 1981 discolored and cast this year. New infections were probably fewer in 1982 than last year because of a drier spring. Trees are expected to have generally healthier foliage next year.

Several reports of Douglas-fir needlecast were received. Saplings on the Rexford District of the Kootenai National Forest and mature trees on the Tally Lake District of the Flathead National Forest were among the reports.

An unusually high frequency of fir-fireweed rust disease was found on the Kootenai and Flathead National Forests. One severely defoliated subalpine fir stand had been proposed for Christmas tree cutting on the Hungry Horse District, Flathead National Forest.

Among the first reports of Swiss needlecast in the Northern Region was the discovery of severely infected Christmas trees on the Fortine District, Kootenai National Forest. On further inspection the disease was found throughout most of the Douglas-fir on the District and into the adjacent Rexford District. Several stands had very high infection rates with virtually all needles cast or infected on individual saplings. This could have serious consequences in areas where Christmas trees are regularly harvested. Thinning foliage as infection persists over several years reduces Christmas tree grade. When trees are cut, infected needles appear normal except for slight dulling of the color and rows of tiny black dots (perithecia) on the undersides. However, shedding of infected needles may begin shortly after the tree has been erected indoors. Swiss needlecast is not likely to have measurable impact other than in Christmas tree quality.

Nelson's juniper rust disease was frequent on Rocky Mountain juniper and ornamental varieties of juniper in the Garrison, Phillipsburg, and Dillon areas, and in the Blackfoot Canyon near Missoula.

Delphinella tip blight was damaging on subalpine fir in a few locations in Montana. Tips of branches and new foliage were shriveled, brown and curved, appearing much like frost damage (Figure 11). Infected stands were examined on Glacier View and Hungry Horse Districts of the Flathead National Forest, and on the Coal Creek State Forest.

Figure 11. Delphinella tip blight of subalpine fir.

Septoria leafspot was associated with severe losses of redstem Ceanothus seedlings which had been planted for big game browse on 8 acres of Troy District, Kootenai National Forest. The fungus may also have caused twig cankers in the Ceanothus seedlings.

A Peridermium rust disease of lodgepole pine infected with dwarf mistletoe was found for the first time in Montana. It was discovered in the Grasshopper Campground on the Dillon District of the Beaverhead National Forest. The fungus superinfects dwarf mistletoe infections. It grows on pine tissue but only where dwarf mistletoe infections are present.

Cankers

Cytospora tip canker of subalpine fir was evident on 40 acres of the Dillon District, Beaverhead National Forest, and in seedlings and saplings in the Elko Campground on the Rocky Moutain District of the Lewis and Clark National Forest. Cytospora cankers often develop following hail damage to young twigs (Figure 12).

Figure 12. Cytospora tip cankers in a young grand fir stand.

Cytospora canker on Engelmann spruce was also reported from the Gallatin National Forest. The shelterbelt trees were severely affected, with some mortality occurring.

A lodgepole pine stand on the Lincoln District of the Helena National Forest and another on the Flathead Indian Reservation were severely damaged by Atropellis canker. The stand on the Lincoln District was mature lodgepole pine with numerous large cankers on most trees. Most of the stand is currently merchantable and was scheduled for removal

with regeneration back to lodgepole pine. However, Atropellis canker is a site-specific problem and would persist if the site was regenerated to lodgepole pine, so Engelmann spruce and Douglas-fir were recommended for regeneration. On the Flathead Indian Reservation the stand was 20 years old and overstocked. About 90 percent of the trees in a 40-acre lodgepole pine stand were infected. Most trees had several infections. This stand is likely to be inadequately stocked at maturity due to mortality resulting from high infection levels. Destruction of the stand and regeneration to other species was recommended.

Comandra blister rust is common on lodgepole pine and ponderosa pine in Montana. The disease is being studied in a cooperative project among the Northern Region, Rocky Mountain Region, and Colorado State University. Grasshopper Campground and three other stands in the Elkhorn Hot Springs area on the Dillon District of the Beaverhead National Forest have severe comandra blister rust infections in lodgepole pine. Permanent plots were established in these stands to study growth and survival of the trees and dynamics of the rust disease.

A sapling lodgepole pine stand on the Lincoln District of the Helena National Forest had localized heavy comandra blister rust infections. Sequoia pitch moth had invaded many of the cankers.

White pine blister rust continues to be a major limiting factor to white pine production. A management guide for white pine is being developed which will aid silviculturists in improving white pine survival. A decision key, working with the Prognosis model, will guide the land manager through a considerable bank of information about white pine blister rust. The key will lead to a set of alternatives, such as use of the proper planting stock, adjusting harvest methods to reduce Ribes populations, and intermediate treatments for existing stands. The guide is expected to be available in spring of 1983.

Dwarf Mistletoes

As routine management is designed with dwarf mistletoe suppression in mind and special suppression projects are completed, impacts from these parasites are continually lessening. On the Bitterroot National Forest, 87 acres were treated in a special dwarf mistletoe suppression project. In similar projects, 300 acres on the Kootenai National Forest and 28 acres of Bureau of Land Management forest in the Garnet Resource Area were treated. Presuppression surveys were conducted on an additional 3,500 acres of the Flathead National Forest and 3,200 acres of the Lolo National Forest. Evaluations for potential special dwarf mistletoe suppression projects were conducted on the Darby, West Fork, and Stevensville Districts of the Bitterroot National Forest, Swan Lake District of the Flathead National Forest, Superior District of the Lolo National Forest, and in the Garnet Resource Area, Bureau of Land Management. All of these stands were recommended to receive pest management funding for dwarf mistletoe suppression.

Nursery Diseases

Ponderosa pine seedlings grown at the Coeur d'Alene Nursery for the Darby District, Bitterroot National Forest and Libby District, Kootenai National Forest, had western gall rust disease. Seedlings infected during their first year, which were a small percentage of the seedling lots, had distinct swellings at the ground line. Most of these were culled before planting.

Recent tests at the Bureau of Indian Affairs Nursery in Ronan indicated that several strains of grey mold on western larch were tolerant to commonly used fungicides, especially Benomyl[1/]. Control trials testing several fungicides against grey mold were initiated at the Champion Timberlands Nursery in Plains. Several fungicides, such as Vinclozolin[1/] and Iprodione[1/], showed promise in controlling this disease.

Damping off continued to cause problems in nonfumigated seedbeds at the Champion Timberlands Nursery. Fungicide drench trials were conducted to reduce losses and provide an option to high-cost soil fumigation. Results have not been analyzed.

A serious canker disease of Russian-olive was found at the Montana Department of State Lands Nursery in Missoula. Cultivation wounds likely provided infection courts for canker-causing organisms.

1/ This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed have been registered. All uses of pesticides must be registered by appropriate state and/or federal agencies before they can be recommended.

COMMON AND SCIENTIFIC NAMES

Insects

Aspen blotchminer	*Lithcolletis tremuloidiella* Braun
Aspen leafminer	*Phyllocnistis populiella* Chambers
Bark beetle	*Hylurgops porosus* (LeConte)
Birch leafminer	*Fenusa pusilla* (Lepeletier)
Douglas-fir beetle	*Dendroctonus pseudotsugae* Hopkins
Douglas-fir tussock moth	*Orgyia pseudotsugata* McDunnough
Fir engraver	*Scolytus ventralis* LeConte
Larch casebearer	*Coleophora laricella* (Hubner)
Lodgepole pine terminal weevil	*Pissodes terminalis* (Hopkins)
Mountain pine beetle	*Dendroctonus ponderosae* Hopkins
Pine bark aphid	*Pineus silvestris* Annand
Pine butterfly	*Neophasia menapia* (Felder & Felder)
Pine engraver	*Ips pini* (Say)
Pine needle sheath miner	*Zelleria haimbachi* Busck
Ponderosa pine needle miner	*Coleotechnites* sp.
Root-collar weevil	*Cylindrocopturus deleoni* Buch.
Spruce beetle	*Dendroctonus rufipennis* Kirby
Ten-lined June beetle	*Polyphylla decemlineata* (Say)
Western balsam bark beetle	*Dryocoetes confusus* Swaine
Western pine beetle	*Dendroctonus brevicomis* LeConte
Western pine shoot borer	*Eucosma sonomana* Kearfott
Western spruce budworm	*Choristoneura occidentalis* Freeman

Diseases

Annosus root rot	*Fomes annosus* (Fr.) Cke.
Armillaria root rot	*Armillaria mellea* Vahl.: Fr.
Atropellis canker	*Atropellis piniphila* (Weir) Lohman & Cush
Black stain root disease	*Verticicladiella wageneri* Kend.
Comandra blister rust	*Cronartium comandrae* Peck.
Cytospora canker (Engelmann spruce)	*Valsa* (*Cytospora*) *kunzei* Fr.
Cytospora tip canker (subalpine fir)	*Cytospora abietis* Sacc.
Damping off	*Fusarium* spp. and *Pythium* spp.
Delphinella tip blight	*Delphinella balsamea* (Waterm.) Mueller
Douglas-fir needlecast	*Rhabdocline pseudotsugae* Syd.
Dwarf mistletoe	*Arceuthobium* spp.
Fir-fireweed rust	*Pucciniastrum epilobii* Otth.
Grey mold	*Botrytis cinerea* Pers.: Fr.
Hypodermella blight	*Hypodermella laricis* Tub.
Lophodermella needle cast	*Lophodermella concolor* (Dear.) Dark.
Meria needlecast	*Meria laricis* Vuill.
Nelson's juniper rust	*Gymnosporangium nelsonii* Arth.
Peridermium rust (new record)	*Peridermium betheli* Hedgc. & Long
Brown cubical root and butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Russian-olive canker	*Phomopsis* sp., *Phoma* sp. and *Ascochyta* sp.
Septoria leafspot (ceanothus)	*Septoria ceanothi* Dearn.
Swiss needlecast	*Phaeocryptopus gaumanni* (Rhode) Petrak
Western gall rust	*Endocronartium harknessii* (Moore) Hirat.
White pine blister rust	*Cronartium ribicola* Fischer: Rabh.

RECENT REPORTS AND PUBLICATIONS

Bousfield, W. 1982. Statewide mortality estimates, ponderosa pine mortality caused by mountain pine beetle for Montana in 1980. USDA Forest Serv., N. Reg., FPM Rpt. 82-8.

Bousfield, W., and A. Chase. 1982. Progress report on spruce budworm damage in the Wall Creek area, Beaverhead NF. USDA Forest Serv., N. Reg., FPM Rpt. 82-12.

Byler, J. W. 1982. An assessment of root diseases in the Northern Region. USDA Forest Serv., N. Reg., FPM Rpt. 82-21.

Byler, J. W., R. L. James, and S. H. Dubreuil. 1982. Etiology and distribution of root diseases on Northern Rocky Mountain conifers. Phytopathology 72:966 (Abstr.).

Dewey, J. E., and M. J. Jenkins. 1982. An evaluation of cone and seed insects in selected seed production areas in R-1. USDA Forest Serv., N. Reg., FPM Rpt. 82-5.

Dewey, J. E., R. L. Livingston, and S. Kohler. 1982. Douglas-fir tussock moth adult male survey, N. Idaho and W. Montana. 1981. USDA Forest Serv., N. Reg., FPM Rpt. 82-20.

Dooling, O. J. 1982. Evaluation of dwarf mistletoe control projects on the West Fork RD, Bitterroot NF. USDA Forest Serv., N. Reg., FPM Rpt. 82-4.

Dooling, O. J. 1982. Evaluation of a dwarf mistletoe control project, Keno-Kennedy Creek Sale, BLM. USDA Forest Serv., N. Reg., FPM Rpt. 82-23.

Dooling, O. J. 1982. Evaluation of dwarf mistletoe control projects on the Superior RD, Lolo NF. USDA Forest Serv., N. Reg., FPM Rpt. 82-24.

Dooling, O. J. 1982. Evaluation of a dwarf mistletoe control project on the Swan Lake RD, Flathead NF. USDA Forest Serv., N. Reg., FPM Rpt. 82-25.

Dooling, O. J. 1982. Evaluation of dwarf mistletoe control projects on the Darby and Stevensville RD's, Bitterroot NF. USDA Forest Serv., N. Reg., FPM Rpt. 82-26.

Dubreuil, S. H. 1982. Western larch needle blight and needlecast in the Northern Region. USDA Forest Serv., N. Reg., FPM Rpt. 82-9.

Dubreuil, S. H., and N. E. Martin. 1982. Development of root galls on Phaeolus schweinitzii infected Douglas-fir (Pseudotsuga menziesii). Phytopathology 72(7): 929 (Abstr).

Dubreuil, S. H., and N. E. Martin. 1982. Occurrence, symptoms, and interactions of Phaeolus schweinitzii and associated fungi causing decay and mortality of conifers. Phytopathology 72(7): 930 (Abstr.).

Dubreuil, S. H., and N. E. Martin. 1982. Symptoms and distributions of Phaeolus schweinitzii and Armillaria mellea in root systems within mixed conifer stands. Phytopathology 72(7): 967 (Abstr.).

Dubreuil, S. H., S. Tunnock, and O. J. Dooling. 1982. Bark beetle history and root disease on the Hungry Horse District, Flathead NF. USDA Forest Serv., N. Reg., FPM Rpt. 82-18.

Fellin, D. G., and J. E. Dewey. 1982. Western spruce budworm. USDA Forest Serv., Forest Insect and Disease Leaflet 53 (revised).

Gibson K. E. 1982. Permanent mountain pine beetle population trend plots: An update. 1982. USDA Forest Serv., N. Reg., FPM Rpt. 82-19.

Gibson, K. E. 1982. Management alternatives for lodgepole pine in recreational facilities threatened by the mountain pine beetle. USDA Forest Serv., N. Reg., FPM Rpt. 82-27.

James, R. L., and F. W. Cobb, Jr. 1982. Variability in virulence of Heterobasidium annosum isolates from ponderosa and jeffrey pine in areas of high and low photochemical air pollution. Plant Dis. 66: 835-837.

James, R. L., F. W. Cobb, Jr., and J. R. Parmeter, Jr. 1982. Effects of ozone on sporulation, spore germination and growth of Fomes annosus. Phytopathology 72: 1205-1208.

James, R. L., and D. Genz. 1982. Evaluation of fungal populations on ponderosa pine seed. USDA Forest Serv., N. Reg., FPM Rpt. 82-22.

James, R. L., and C. A. Stewart. 1982. Evaluation of conifer regeneration mortality from root diseases on the Cabinet RD, Kootenai NF, Montana--establishment report. USDA Forest Serv., N. Reg., FPM Rpt. 82-29.

James, R. L., C. A. Stewart, and S. H. Dubreuil. 1982. Evaluation of root disease losses on the Blue Fat Timber Sale, Cabinet RD, Kootenai NF, Montana. USDA Forest Serv., N. Reg., FPM Rpt. 82-3.

James, R. L., C. A. Stewart, R. E. Williams, and J. W. Byles. 1982. Root disease mortality of northern Rocky Mountain conifers. Phytopathology 72: 966 (Abstr.).

Kohler, S. 1982. Some insect pests of ornamental trees in Montana. Montana Dept. State Lands, Forestry Div., Insect and Disease Rpt. 82-1.

McGregor, M. D. 1982. The current situation of the mountain pine beetle in the United States and resource involved. Proceedings of the Joint CANADA/USA Workshop on Mountain Pine Beetle Related Problems in Western North America.

McGregor, M. D., K. E. Gibson, and R. D. Oakes. 1982. Status of mountain pine beetle infestations, Flathead NF and other portions of Montana, 1981. USDA Forest Serv., N. Reg., FPM Rpt. 82-6.

Niwa, C. G. 1982. Environmental factors influencing the effectiveness of Agathis pumila Ratz. (Hymenoptera: Braconidae) an introduced parasite of the larch casebearer, Coleophora laricella Hbn. (Lepidoptera: Coleophoridae). M.S. Thesis, Univ. of Idaho, Moscow.

Stipe, L. E., C. G. Niwa, K. E. Gibson, H. E. Meyer, and R. Eder. 1983. Bt pilot project against western spruce budworm in central Montana, 1981. USDA Forest Serv., N. Reg., CFPM Rpt. 83-4. (in press).

Tunnock, S., and H. E. Meyer. 1982. Potential defoliation in 1982 by a ponderosa pine needle miner in the Flathead Indian Reservation. USDA Forest Serv., N. Reg., FPM Rpt. 82-13.

Tunnock, S., S. H. Dubreuil, and S. Kohler. 1982. Forest insect and disease conditions in Montana, 1981. USDA Forest Serv., N. Reg. and Montana Dept. State Lands, FPM Rpt. 82-2.